Elemental Abundances of the Mercury Manganese Stars

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With my colleagues, Glenn Wahlgren, and Scott Roby, I obtained low dispersion SWP and LWP trailed spectra of both HR 1094 and γ Gem; sufficient high dispersion SWP and LWP observations of 53 Tau and χ Lup for coadditions which are well exposed over the full wavelength range of the IUE cameras, and several high dispersion SWP and LWP observations of both HR 1094 and γ Gem for coadditions which have good signal-to-noise ratios in the long wavelength portions of both camera. Low dispersion trailed SWP and LWP exposures of both χ Lup and 53 Tau had been obtained by us in an earlier IUE program.

Both 53 Tau and HR 1094 have chemical compositions which are somewhat unusual even for Mercury-Manganese stars, being respectively extremely iron poor and extremely cobalt rich. Their coadded spectra and ultraviolet energy distributions are thus different from those of other normal and Mercury-Manganese stars which we have studied. This is not unexpected as their non-solar patterns of their elemental abundances for the iron peak elements lead to differences in the ultraviolet line blanketing. Comparison of the high dispersion HR1094 spectra with those of other stars shows many lines which are absent in the other spectra. Studies of such lines have the potential to improve our knowledge of the atomic spectra of Co II and Co III as well as other very overabundant species in HR 1094. I have also obtained a 67 Å section of this star's spectrum in the optical region and could only identify 25% of the lines in a region which in other stars I usually could identify 95%+ of the lines.

As the companion of γ Gem is some five magnitudes fainter in the optical region, in the ultraviolet its contribution to the spectrum is negligible. Further as it is a bright, sharp-lined stars whose elemental abundances are as near solar as such main sequence stars go, it is a candidate to become a new early A standard.

The observations of χ Lup were obtained so that the lines of the primary and

secondary were well separated and that the relative Doppler shifts were about the same for all exposures. This data is being compared with GHRS observations of this star. Lines not in the regions of overlap will be used to study species which have not be as yet studied in the ultraviolet.

We have just begun to determine the effective temperatures and surface gravities of these stars as part of a more general study. We are using a program written by Austin Gulliver and Graham Hill to compare observed fluxes and Balmer line profiles with the predictions of ATLAS9 model atmospheres. Adelman and Gulliver have been calculating extensive grids of such model atmospheres for this purpose using his DEC 3000 model 300X workstation and similar DEC Alpha computers at Brandon University.

Once these parameters have been determined, we plan to analyze the iron peak and nitrogen abundances as did Roby, Adelman, Leckrone, Cowley, and Wahlgren (1994, in Peculiar vs. Normal Phenomena in A-Type and Related Stars, ASP Conference Series, 44, p. 154) and then proceed to work on additional elements.